Degeneracy
Languages' strategy to withstand stress

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"De Saussure's frustration"

- If language is a system based on differential links between interlocking constructions, language change should not occur.

> “[L]es faits diachroniques sont particuliers; le déplacement d'un système se fait sous l'action d'événements qui non seulement lui sont étrangers (...), mais qui sont isolés et ne forment pas système entre eux.” (De Saussure 1955[1916]:134)

Introduction

- Constructions: defined as form-function pairings

- Naïve view: this pairing should be fixed

  If meaning A corresponds to forms {X, Y, Z}, and form X corresponds to meanings {A, B, C} (many-to-many mapping, instead of Humboldtian isomorphism), then language users have a hard time decoding and encoding language

- Homonymy (polysemy) and synonymy are avoided (Haiman 1980; McMahon 1994: 85)

- However: in reality isomorphism is contstantly violated...

Violations of isomorphism

- Similarity in form begets similarity in function and vice versa (De Smet 2010, Fonteyn 2016).

- Superficial (i.e. etymologically unwarranted) similarity may affect the formal realization of neighbouring constructions (Pijpops & Van de Velde 2016; Pijpops, De Smet & Van de Velde, ms.) and may lead to diachronic merger of distinct lineages (Van de Velde & Van der Horst 2013; Van de Velde, Ghesquière & De Smet 2013)

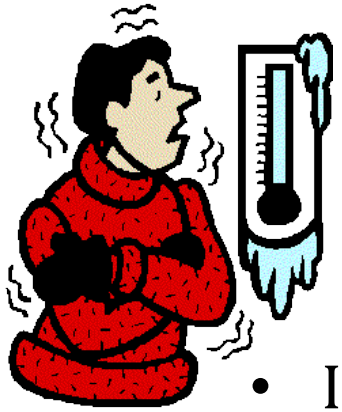
- Forms with partially overlapping functions may attract each other leading to full overlap in functions (De Smet, D'hoedt, Fonteyn & Van Goethem, forthc.)

- In sum, constructions constantly interact on a formal as well as a functional-semantic level. This multitude of complex interactions causes that forms and functions do not exhibit one-to-one, but **many-to-many** relationships.

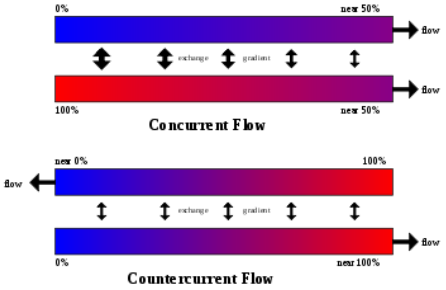
Degeneracy

- Degeneracy is a technical term.
  - Not: 'deterioration'
  - But: the technical meaning from evolutionary biology: "the ability of elements that are structurally different to perform the same function or yield the same output" (Edelman & Gally 2001:13763)

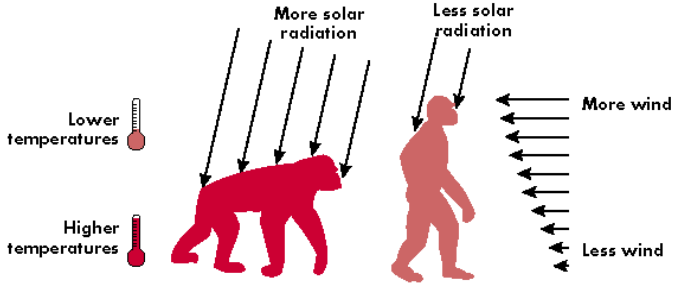
- Typically, the structurally different elements are at the same time involved in other functions as well.



Examples of degeneracy



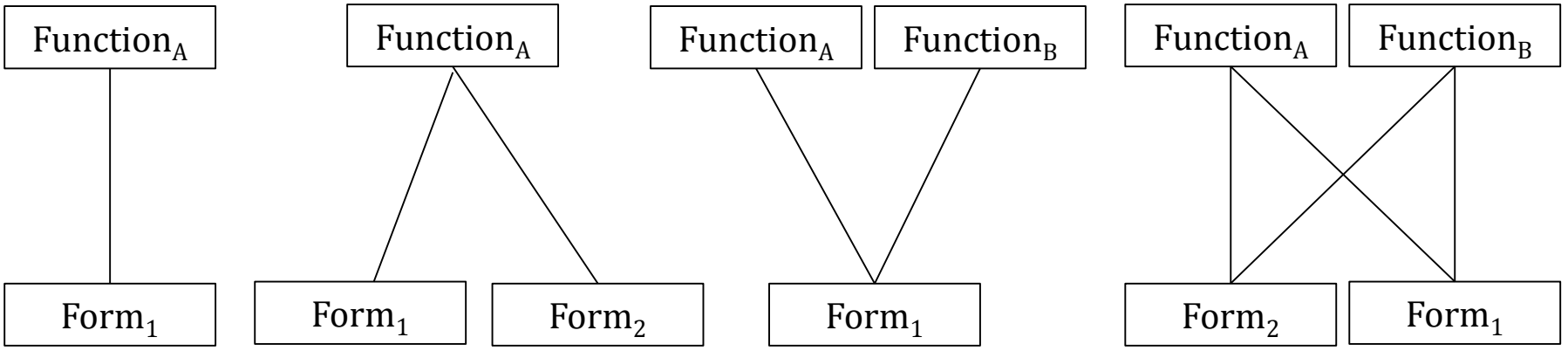
- In biology
  - Thermoregulation in the human body
    - shivering
    - countercurrent flow
    - perspiration
    - arteriolar vasodilation
    - wearing protective clothing
    - huddling
    - walking upright
    - goose bumps



Degeneracy: many-to-many

	Thermoregulation	Other functions
walking upright	• cooling down by catching less solar radiation • cooling down by catching more wind	• increase of visual perimeter • energetic advantages in locomotion • freeing of hands
arteriolar vasodilation / vasorestriction	• avoiding heat loss by reducing the flow of blood	• decreasing blood pressure • regulate oxygen transport
huddling	• sharing in the metabolic thermogenesis of conspecifics	• social bonding • confusing predators
perspiration	• cooling down by condensation	• removal of toxins from body

Degeneracy and related notions



Isomorphy (1 to 1)

Redundancy (synonymy)

Pleiotropy (homonymy)

Degeneracy (many to many)

Degeneracy in CAS

- Degeneracy is a common feature of so-called 'complex adaptive systems'

- Complex adaptive systems (Holland 1992)
  - ant colonies (e.g. Hölldobler & Wilson 2008)
  - stock market (e.g. Mauboussin 2002)
  - human body
  - language (Beckner et al. 2009; Bybee 2010; Steels 2011)

- What is the role of degeneracy in CAS?
  - robustness and evolvability (Whitacre & Bender 2010)

Degeneracy in language

- Language is a complex adaptive system
- Complex adaptive systems display degeneracy
- Languages display degeneracy
  - Van de Velde (2014): morphosyntax
  - Winter (2014): phonology
  - Van de Velde & Fonteyn (2017): morphosyntax

Degeneracy in language

- Examples of degeneracy in morphosyntax:
  - the marking of the plural by both umlaut and a plural suffix (German *Mann* – *M**ä**nn**er***)
  - the expression of aorist (preterite) both by a prefixed 'augment' *e-* and a suffixed sigmatic marker -s- in Ancient Greek and Old Indic aorists (Ancient Greek ***é**-lu-**s**-a* 'I unbound')
- Note that we have a many-to-many mapping here:
  - Umlaut also plays a role in verbal morphology. The *-er* suffix also plays a role in forming nomina agentis and in marking the comparative
  - the augment *e-* is also found in the imperfect. The marker *-s-* also marks the future.
- Robustness:
  - Some plurals have either umlaut or only a plural suffix
  - some aorists have no sigmatic marker, and in non-indicative mood, they lack the augment.
- Evolvability:
  - restructuring of the Greek aspectual system: sigmatic marker for perfectivity, also in future (Koutsoukos 2013)

Degeneracy in language

- Argument realisation in psych verbs
- Auxiliaries
- Possession constructions in West-Germanic
- Indo-European perfects
- Interrogatives in Germanic

Argument realisation

- Middle Dutch relies on case for indicating the agentivity of the participants (Van de Velde 2004)

- Agentivity can be broken down into features like volition, responsibility, control, animacy, instigation, movement etc. (Lakoff 1977; Dowty 1991; Næss 2007; Grimm 2011, among others)

- Case system (see Næss 2007:198):
  - Nominative: sentient, volitional, instigating
  - Accusative: non-sentient, involitional, affected
  - Dative: sentient, volitional, but non-instigating
  - Genitive: involitional, not fully affected (source)

- AGENTIVE nominative – dative – genitive – accusative NON-AGENTIVE (PATIENTIVE)

Argument realisation

- The system works well for causal motion, or transfer ('billiard ball' events)
- For experiencer processes (*shame*, *amaze*, *wonder*, *annoy, forget* ...), the causality is less straightforward: who or what is the instigator?
- Wide range of case frames

(1) **nominative-stimulus, dative-experiencer**
Sere wonderde Pharaone sine vulmaectheit so scone
much amazes Pharao:DAT his:NOM perfection:NOM so beautiful
'Pharao was amazed by his very beautiful perfection'

(2) **genitive-stimulus, dative-experiencer**
Des wondert mi utermaten
this:GEN amazes me:DAT highly
'I was highly astonished by this'

(3) **nominative-experiencer, accusative-stimulus**
Die goede man, die in clenen dingen die grootheit van onsen here plach te wonderne wel zere
the good man, who:NOM in little things the:ACC greatness:ACC of our:DAT lord:DAT used to amaze well very
'The good man, who used to be highly amazed about the greatness of our lord by little things'

(4) **nominative-experiencer, genitive-stimulus**
Si wondrens sere algader
they:NOM wonder=this:GEN much altogether
'They were all highly astonished about this'

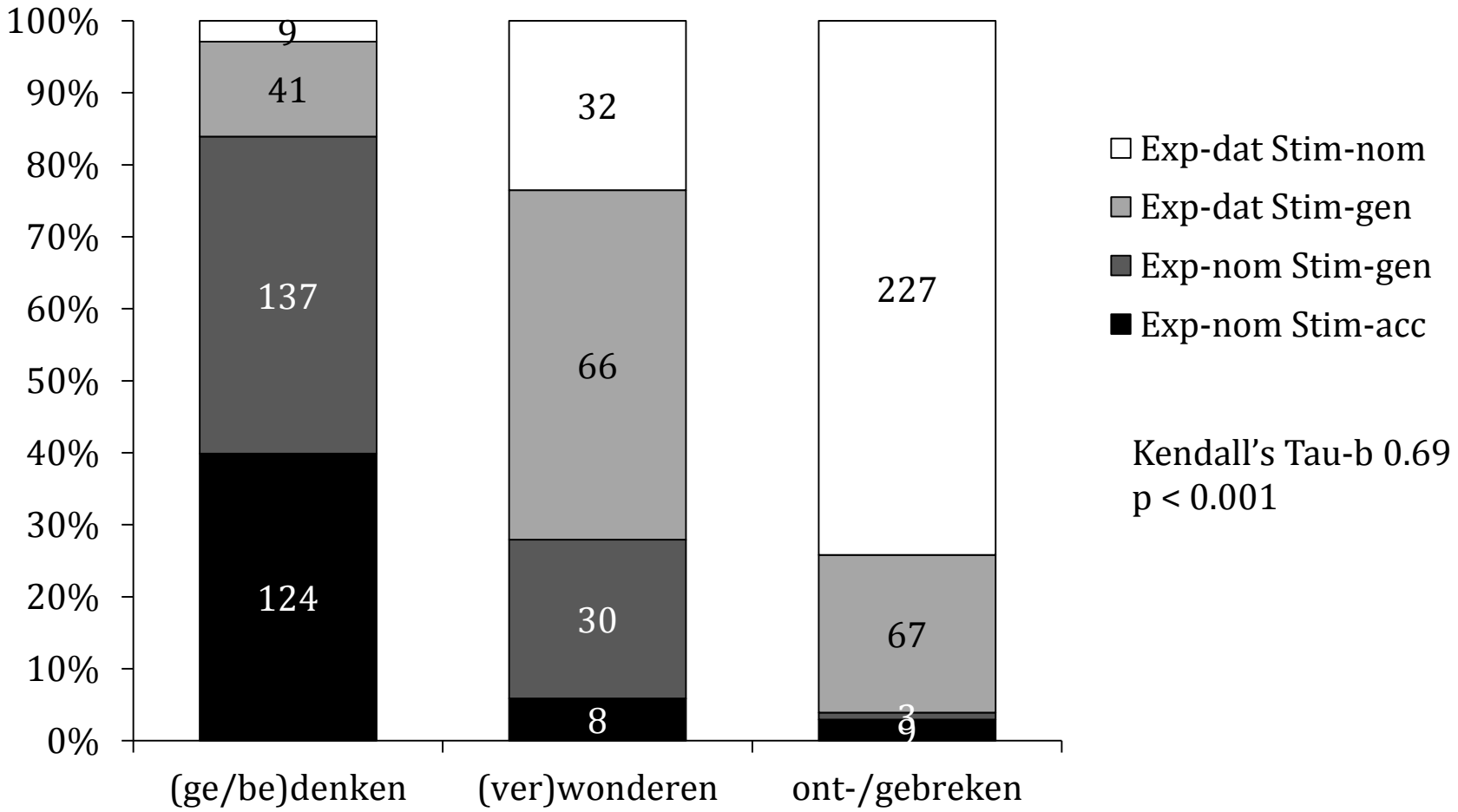
Argument realisation

AGENTIVE EXPERIENCER	
	Experiencer-nominative; Stimulus-accusative
	Experiencer-nominative; Stimulus-genitive
	Experiencer-dative; Stimulus-genitive
	Experiencer-dative; Stimulus-nominative
NON-AGENTIVE EXPERIENCER	

- Van de Velde (2004): distribution of the different constructions over the experiencer verbs is semantically motivated:
  - verbs with an inherently more agentive experiencer (e.g. *denken* 'think') ~ experiencer as actor
  - verbs with an inherently less agentive experiencer (e.g. *ontbreken* 'lack') ~ experiencer as an undergoer.
  - verbs that take a middle position (e.g. *wonderen* 'amaze') ~ impersonal construction (dat-exp / gen-stim)

Argument realisation

- three verbs: *(ge/be)denken* ('think'), *verwonderen* ('amaze'), *ont-/gebreken* ('lack')



Degeneracy in argument realisation

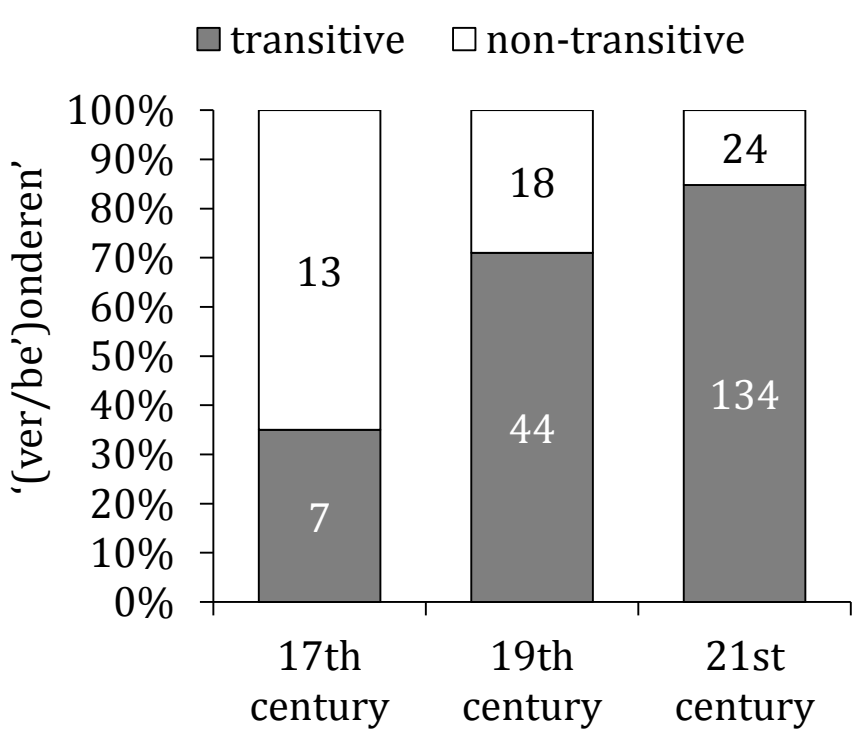
- Case system erodes (deflection)
- Is there a degenerate strategy?
- Yes, there is:
  - prepositions

    (1) *Hen allen wonderde **van** dien* (MNW s.v. wonderen)
    they:DAT all:DAT amazed **of** this:DAT
    'They were all amazed by this'

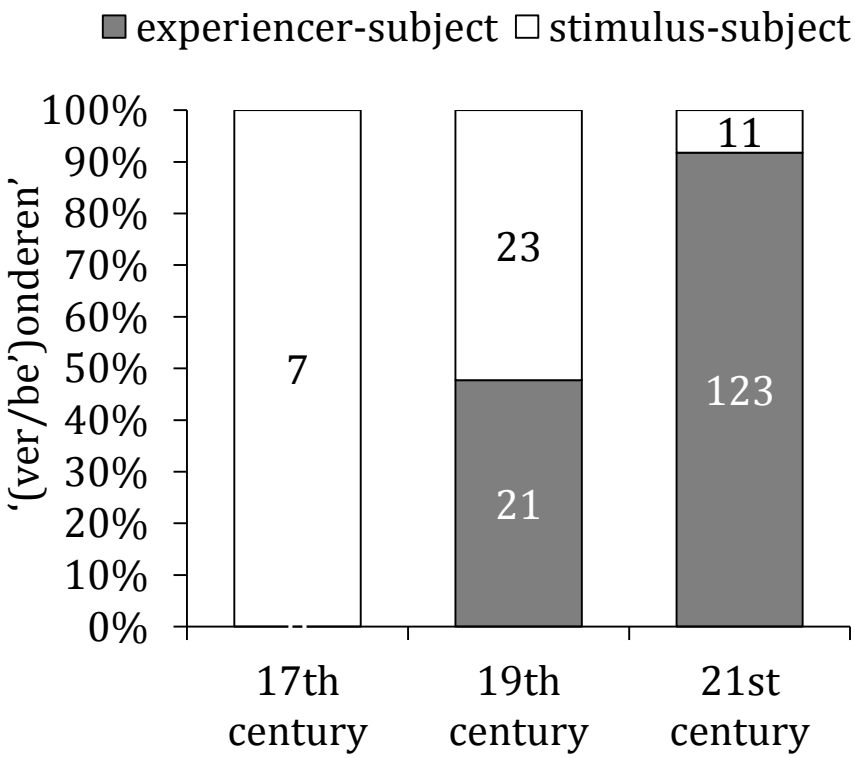
  - Extension of transitive clauses (exp-su)
  - Applicative morphology (*wonderen/bewonderen*, *denken/bedenken* …)
  - New voice-based distinctions

Degeneracy in argument realisation

- Extension of transitive clauses (exp-su) (see also Allen 1995, Trousdale 2008, a.o.)



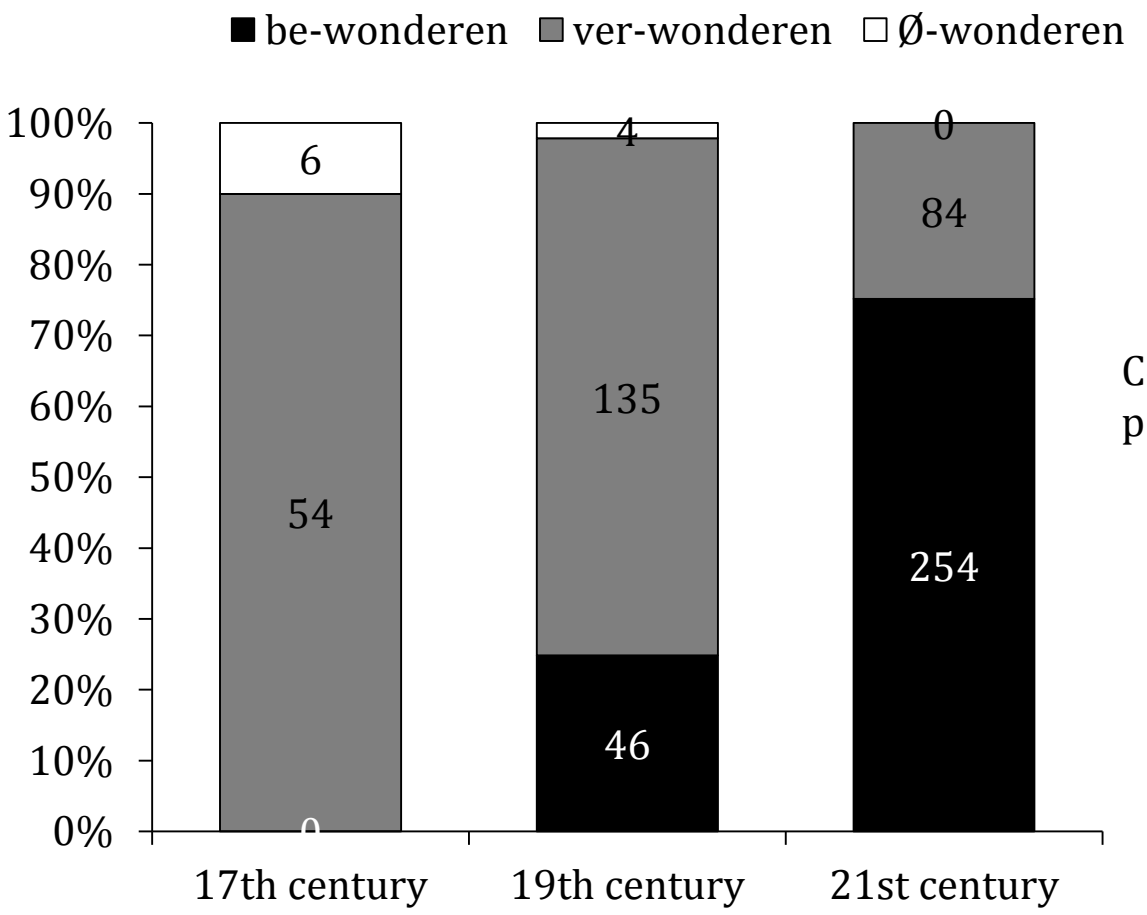
Kendall's Tau-b 0.28 p < 0.001



Kendall's Tau-b 0.56 p < 0.001

Degeneracy in argument realisation

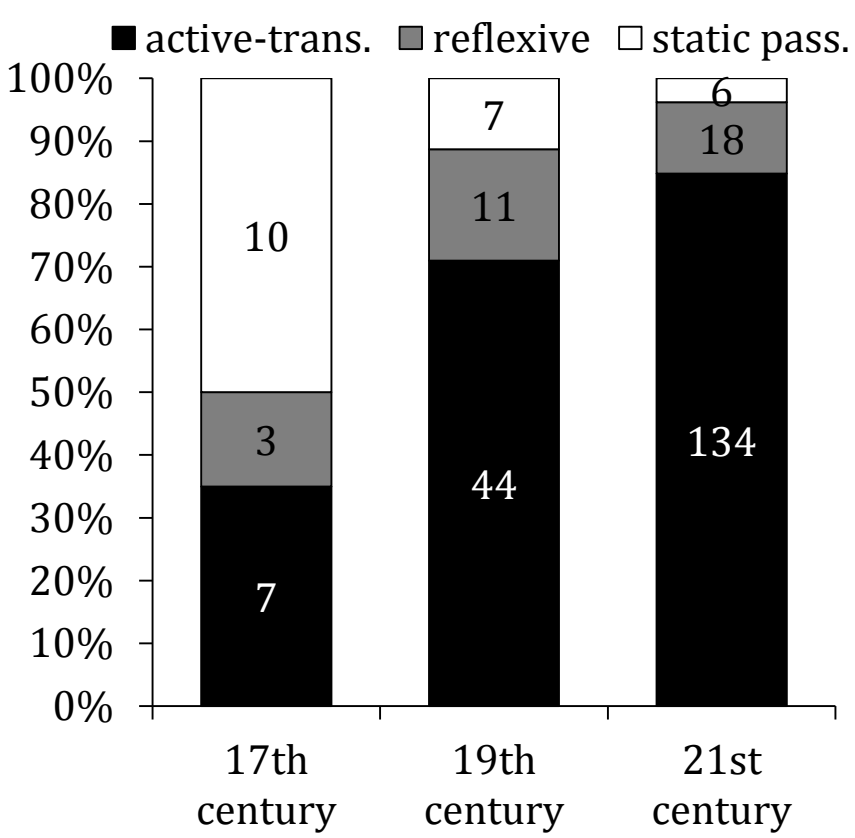
- Applicative morphology

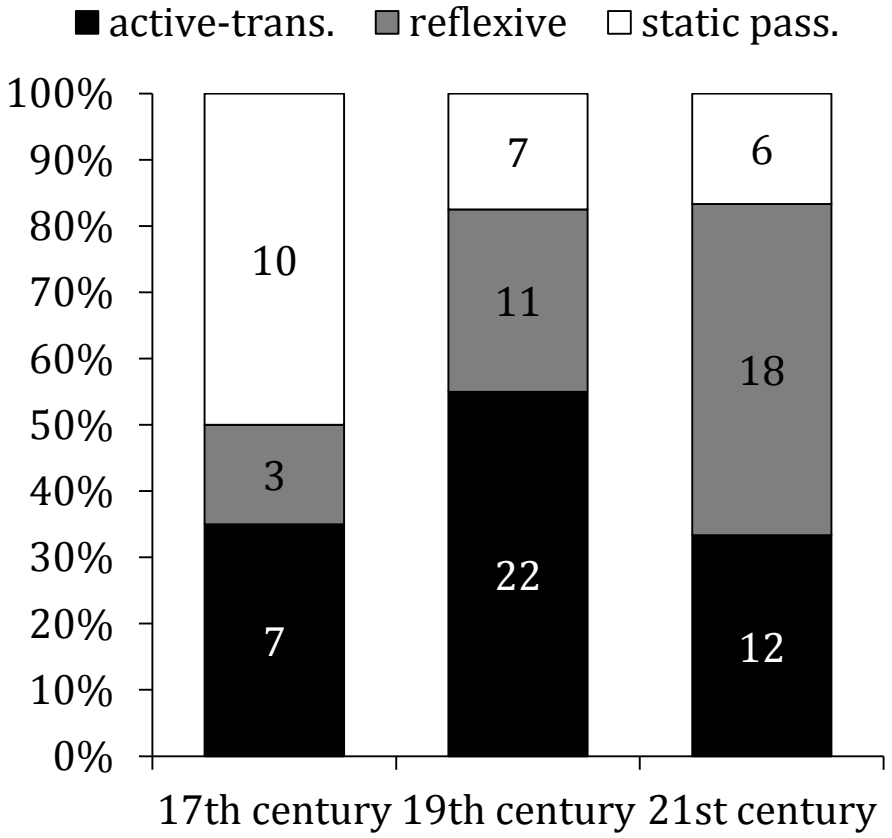


Cohran-Mantel-Haenszel-2
$p < 0.001$

Degeneracy in argument realisation

- New voice-based distinctions (re-establishing gradient argument structure)





only *(ver)wonderen*

Degeneracy in argument realisation

- Is this degeneracy? Yes:
  - Strategies do not all stand in a simple trade-off relation. All strategies existed in Middle Dutch and Old Dutch already, sometimes in mixed form:

    Old Dutch (LW 107,05, ca. 1100)

    thu wunderost thich thero uirtutum ande thero profectuum

    thou wonderst REFL that:GEN.PL virtues and that:GEN.PL successes:GEN.PL

    'you marvel at the virtues and successes'

    (reflexive + genitive-stimulus)
  - Strategies serve other functions elsewhere in the system: marking allative relations, reciprocal predicates, passives … (many-to-many relationships)
  - Strategies are causally related (they can become more prominent to back up for loss due to deflection)

Auxiliaries

- Auxiliaries are degenerately marked (partial lists are provided in Hammerich 1960; Van der Horst 2008:873-896 for Dutch, Warner 1993:3-9 for English)
  1. preterite-present inflection
  2. clustering in the verbal endgroup
  3. contracted negation and polarity-sensitive root apophony
  4. subject-verb inversion
  5. infinitivus pro participio (IPP)
  6. clitic realisation
  7. lack of non-finite use
  8. st-preterite (*wist, moest, cost, begost*)
  9. ould-preterite (*would, could, should*)

  ...
- Not all languages use the same set of degenerate markers
  - Dutch: 1, 2, 5, (6), 8†
  - English: 1, 3, 4, 6, 7, 9
  - Depends on language structure (Fischer 1997)

Auxiliaries

- Is this degeneracy? Yes:
  - Not just an increase in the number of aux features (road to auxiliariness)
  - Features may wax and wane (e.g. -st preterite)
  - Features only apply to subsets of aux (similar to other cases of degeneracy, e.g. ablaut vs. dental preterites)

Indo-European perfect

- Proto-Indo-European made heavy use of root-vowel apophony (ablaut):

	root	e-grade	o-grade	zero-grade
PIE		present	perfect	aorist
Class. Greek	*l_ip*	*leíp-ō*	*lé-loip-a*	*é-lip-on*

- The perfect was degenerately marked by:
  - o-grade
  - specific endings: *-h_2*, *-th_2* and *-e* for 1/2/3SG
  - reduplication

- Degeneracy, because:
  - o-grade occasionally occurred in presents (e.g. Greek *dokéō* 'teach' < PIE root **dek̑-*, Pokorny (1959: 189-191), or Greek *akoúō* 'hear' < **$h_2$kous-*)
  - reduplication occasionally occured in other tenses (e.g. Luwian *titaimi-*'nurtured' < PIE **d^hi-d^heh_1-*, root *d^heh_1(y)-* 'suckle')

Indo-European perfect

- Robustness and evolvability:
  - Robustness: endings got lost, perfect remained (though with expected function shift: state > perfective > preterite)
  - Evolvability (Van de Velde, forthc.): Proto-Germanic reanalysed the o-grade: singular of preterite (Lass 1990), modals. Ablaut system was extended: non-ablauting class VII verbs (Go. *saíslēp* > Du. *sliep*) started ablauting and non-preterite present modals were integrated in the modal system: **kann* 'recognises, knows how', **ann* 'grants', **mag* 'can', **skal* 'owes', **mōt* 'is allowed to' **lais* 'knows'

Possession constructions in West-Germanic

- Dative-external possessor (Van de Velde & Lamiroy 2017)

GERMAN (König & Haspelmath 1998:526)
Die Mutter wäscht dem Kind die Haare.
the mother washes the:DAT child the hair:PL
'The mother is washing the child's hair.'

External possessors: possessor and possessee are not in the same constituent

vs.

Internal possessors: possessor and possessee are in the same constituent

GERMAN
mit einer Albanerin, welche die Haare vom Kind abgeschnitten hat
with an Albanian_woman who the hair:PL of_the:DAT child cut_off has
'with an Albanian woman who cut off the child's hair'

External possessors in West-Germanic

- (Dative) external possessor is not equally productive throughout the West-Germanic languages, but display a typical Van-Haeringen-pattern (E < D < G):
  - English: nearly non-existent (some relics notwithstanding)
  - Dutch: unproductive, but survives in fixed expressions and special constructions (see disagreement Haspelmath 1999 vs. Van Pottelberghe 2001)
  - German: fairly common

(1a) ***Ihm*** *schmerzt der Bauch*

(1b) **De buik doet* ***hem*** *pijn*

(1b') ***Mi*** *is den buuc so gheladen* (Middle Dutch, Burridge 1996)

(1c) **The stomach aches* ***him***

(2a) *Er wollte* ***mir*** *die Kehle durchschneiden*

(2b) *Hij wou* ***me*** *de keel oversnijden*

(2c) **He wanted to cut* ***me*** *the throat*

External possessors in West-Germanic

- Dative external possessors are attested in the oldest stages of Germanic languages

GOTHIC (John 9, 15)
Fani galagida mis ana augona
clay:ACC.SG put:PST.3SG me:DAT on eyes:ACC.PL
'He put clay into my eyes'

OLD HIGH GERMAN (Havers 1911:285)
So riuzit thir thaz herza
then mourns you:DAT the heart
'Then your heart will mourn'

OLD SAXON (Havers 1911:293)
Thiu hlust uuarð imu farhauuan
the ear was him:DAT hewn
'His ear was cut off'

OLD ENGLISH (Traugott 1992:205-206)
... him mon aslog þæt heafod of him:DAT
one cut the head off
'... they cut his head off'

OLD DUTCH (ONW s.v. fuot)
Tho bat her that min ímo an themo cruce up kerde the uóze.
then asked he that one him:DAT on the cross up turned the feet
'Then he asked that they would turn his feet up on the cross.'

External-possessor in West-Germanic

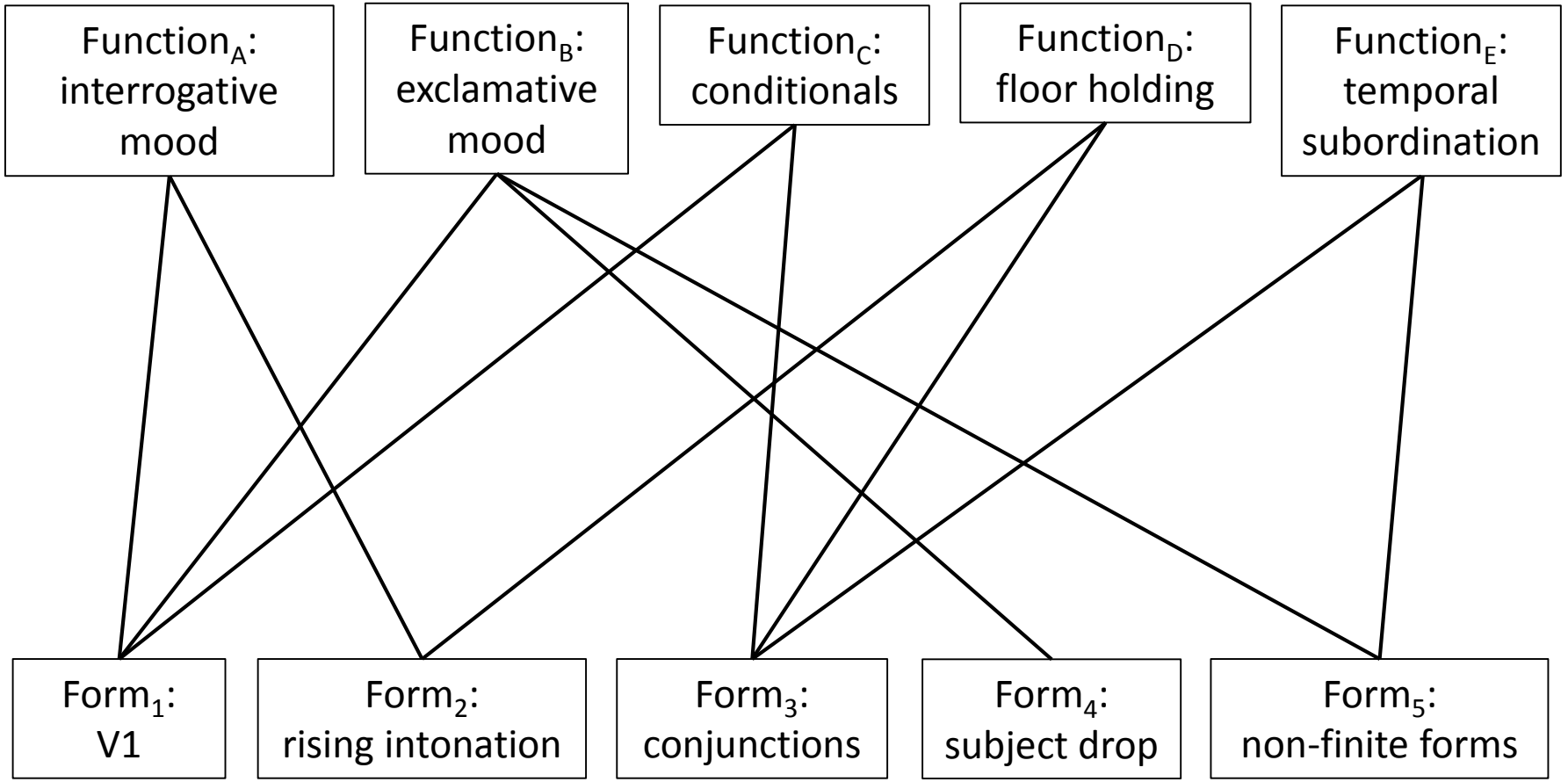
- Dative-external possessor comes under pressure from the loss of the dative, and from competition from increased NP-structure
- How do languages cope? By relying on degeneracy:
  - prenominal attributive possessor: *Vaters Haare wurden grau*
  - postnominal PP possessor: *die Haare vom Kind*
  - resumptive possessive pronoun: *meinem Bruder sein Auto*
- Languages may idiosyncratically strenghten one of the alternatives:
  - prenominal attributive poss: German (with true genitive)
  - postnominal PP poss: English
  - RPP: Dutch
  - PP-external possessor: Norwegian:

    Legen røntgenfotograferte magen på dei.
    the.doctor radiographed the.stomach on them
    'The doctor radiographed their stomach.'

Interrogative mood in Germanic

- “Word-position has acquired grammatical significance.” (Jespersen 1993[1894]:111)
- Stepwise development (Faarlund 2001:1708; Hock 2015; Hopper 1975; Van der Horst 2008)
  - Proto-Germanic: pragmatically-driven word order with strong tendency to put V in final position
  - After desintegration of Germanic unity (> 400-500): rise of V2 - trail blazed by Wackernagel's position of clitic auxiliaries
  - As a consequence, the contrast with V1 and V-final was grammaticalized, by contrast:
    - V2: declarative main clauses
    - V-final (relic): subordinate clauses (backgrounding)
    - V1: non-assertional contexts: interrogatives, (irrealis) conditionals, imperatives ... (Daalder 1983; Van der Horst 1984, 1995; Diessel 1997; Goldberg & Del Giudice 2005; Leuschner 2016 (pace Beekhuizen 2016))

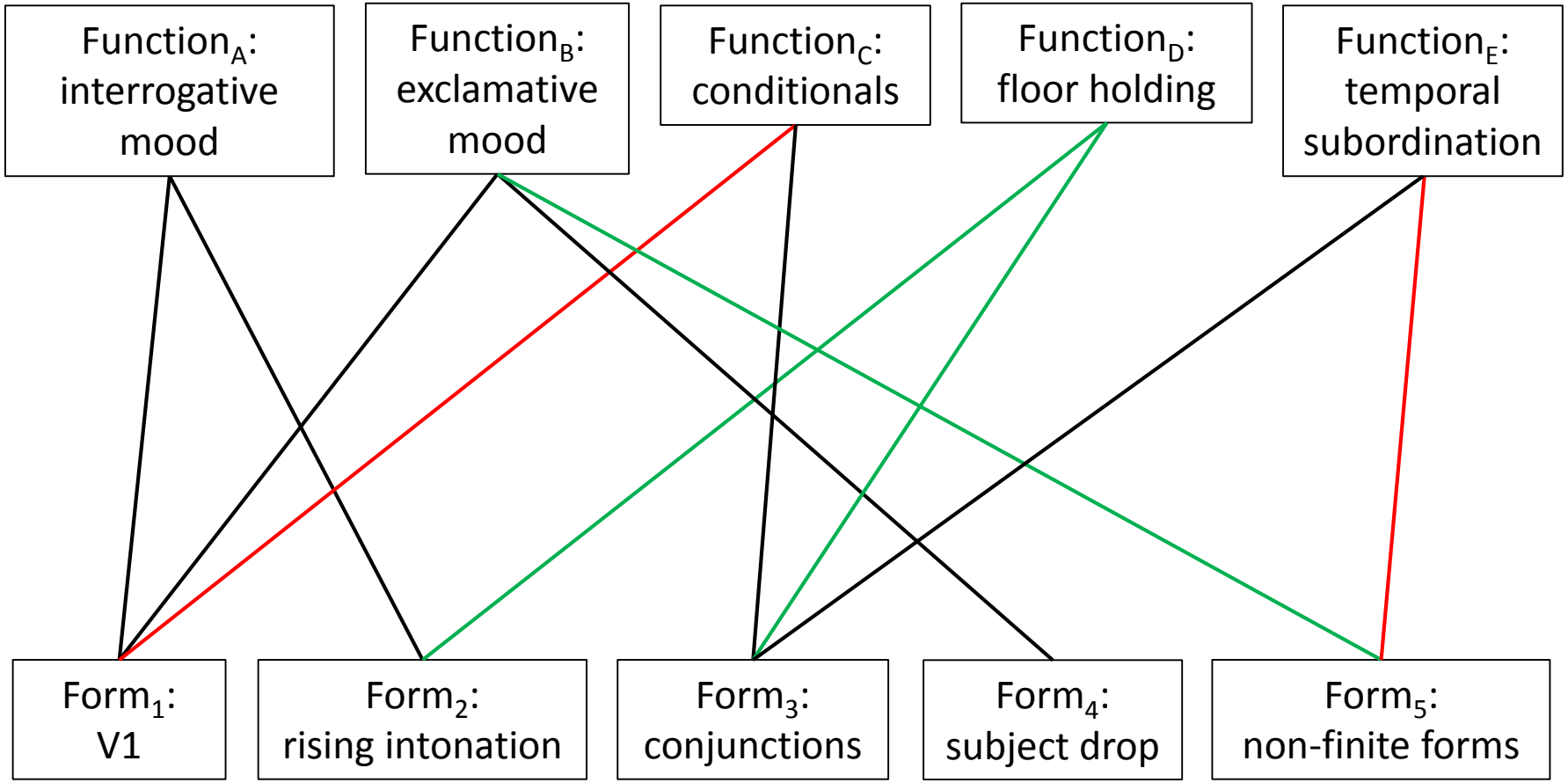
Partial degenerate network in Germanic



Partial degenerate network in Germanic

diachronically on the rise

diachronically on the decline



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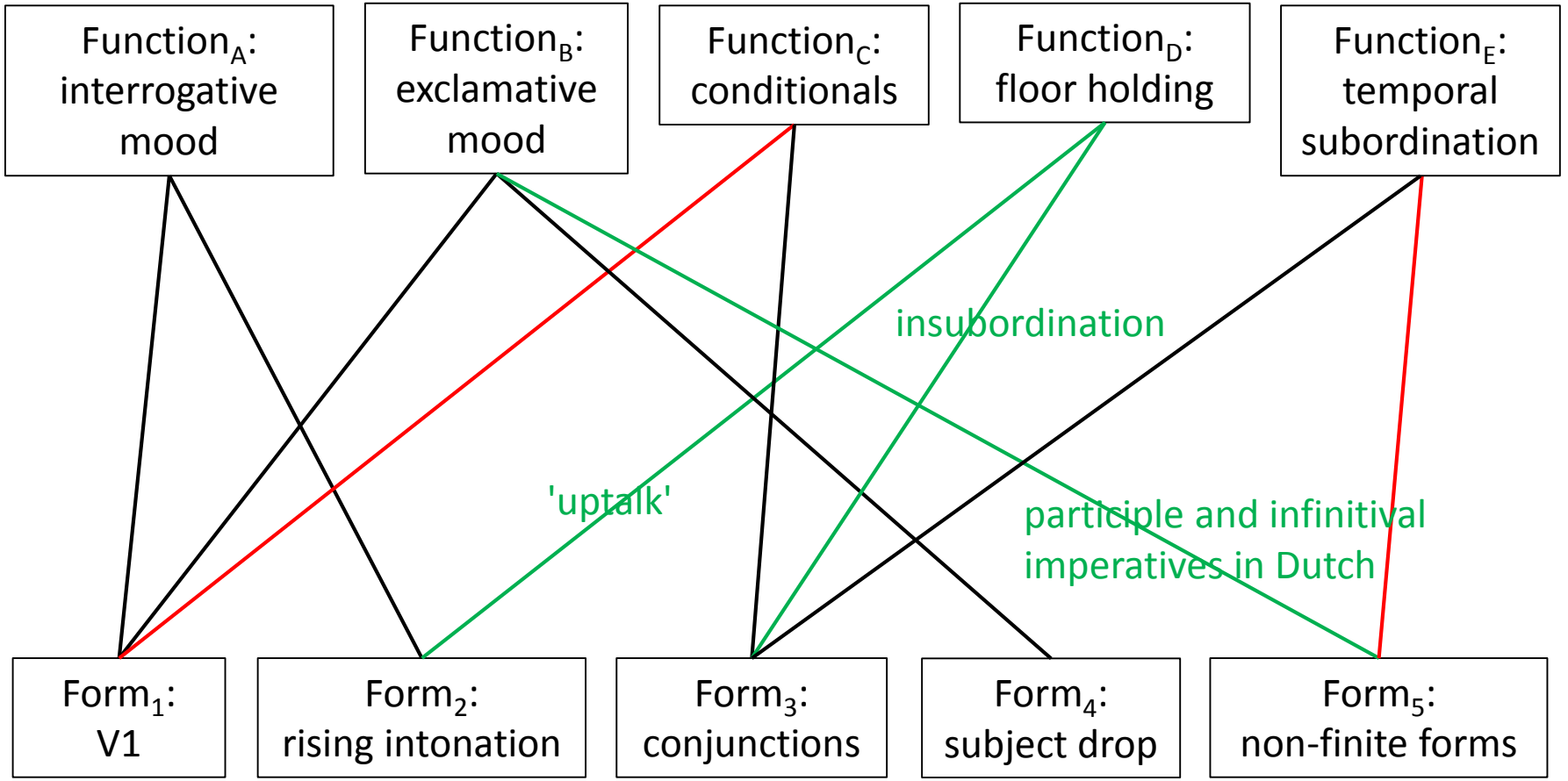

Degeneracy in Dutch interrogatives

	Sentence type			
	statement	wh-q	y/n-q	declarative q.
Rising intonation	-	-	+/-	+
lexical marker of interrogative mood	-	+	-	-
syntactic marker of interrogative mood (inversion)	-	(+)	+	-

Degeneracy in Dutch interrogatives

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Rising intonation	-	-	+/-	+
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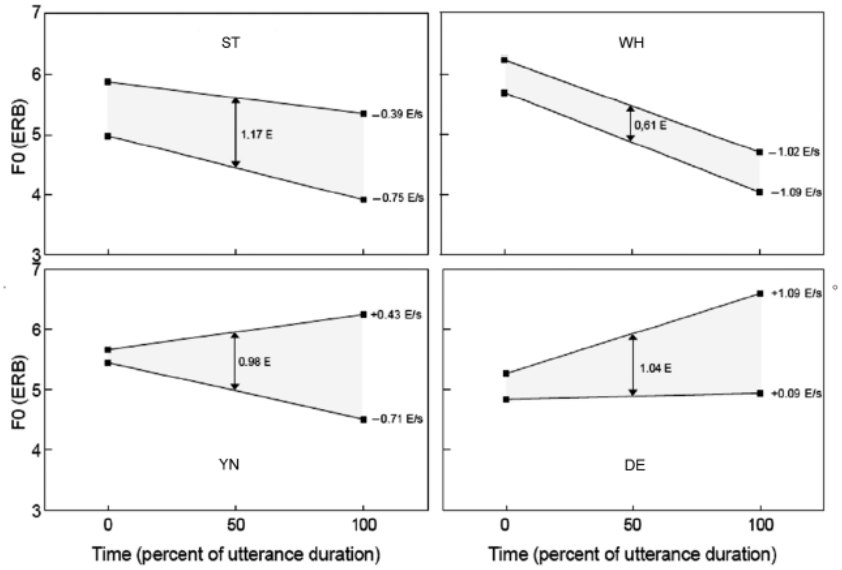
Van Heuven (2017)



Degeneracy - conclusions

- A one-to-one mapping between form and function may not be the gold standard for constructions. There are benefits of a many-to-many mapping ('degeneracy'):
  - (1) robustness
  - (2) evolvability

- In that sense, language behaves as other complex adaptive systems.

- Language change often transpires in the strengthening or weaking of already existing strategies, possibly deployed elsewhere in the grammatical system, rather than by 'renewal' through a radically new grammatical form

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